



Valorising waste heat for enhanced energy efficiency

26th May 2023

Marco Baresi – Turboden SpA, Institutional Affairs and Marketing Director



EU HEATLEAP PROJECT (2020-2023)








- ★ Reference: LIFE19 CCM/IT/001334
- ★ Acronym: LIFE HEATLEAP
- 🕒 Start Date: 01/06/2020
- 🕒 End Date: 31/08/2023
- € Total Eligible Budget: 4,487,668 €
- 🇪🇺 EU Contribution: 2,468,216 €
- 📍 Project Location:

The HEATLEAP project aims to demonstrate the environmental and economic benefits of **waste heat recovery** systems such as **large heat pumps** in energy intensive industries and **gas expanders** in gas distribution networks by testing these technologies at real scale.

The project is funded under the **LIFE programme**, the EU’s funding instrument for the environment and climate action.



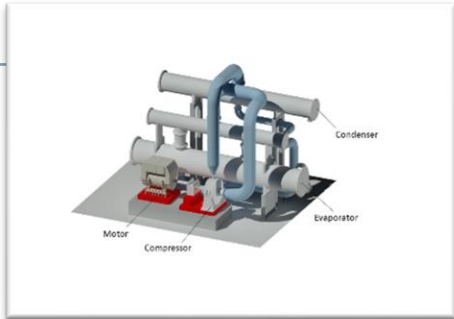
Benefits

 Energy efficiency goes up	 Emissions go down	 Energy bills go down	 Industry more competitive	 Surrounding districts enjoy sustainable heat
---	---	--	---	--

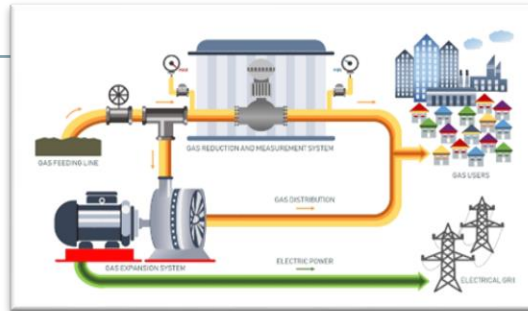
www.heatleap-project.eu



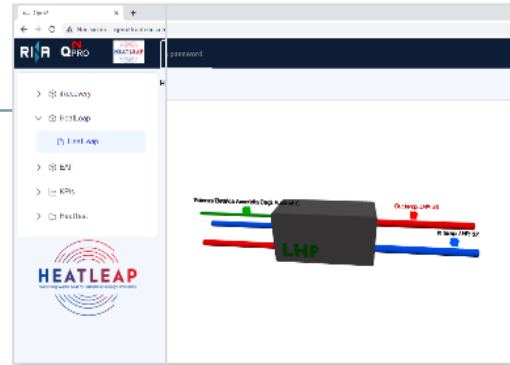
PROJECT'S HIGHLIGHTS



Innovative Large Heat Pump (LHP) with a size of up to 6MWth, able to supply District Heating with temperatures up to 120° C and characterized by a COP between 5 and 8, thanks also to an innovative working fluid



Innovative Gas Expander (GEX), able to recover pressure drop from the decompression of Gas from the grid generating electricity in the range <1 MWe



Implementation of a **monitoring system** collecting and processing data in order to evaluate the real environmental benefits (e.g. air pollutant and greenhouse gas reduction, etc...)

Data			
Date			
Company			
Type			
Reference person			
e-mail			
Exp. process			

Technical data			
Data stated data are mandatory for a preliminary evaluation			
Cold source			
Heat source (°C)	W. Water, Air...	Secondary a	
Pressure (atm)	Water/Coolant	Secondary a	
Heat Temperature (°C)	°C	Secondary a	
Cooling Temperature (°C)	°C	Primary	
Flow rate (t/h)	m3/h	Secondary	
Thermal power available	MW	WT	
Hot source			
Heat source (°C)	W. Water, Air...	Secondary a	
Pressure (atm)	Water/Coolant	Secondary a	
Heat Temperature (°C)	°C	Secondary a	
Cooling Temperature (°C)	°C	Primary	
Flow rate (t/h)	m3/h	Secondary	
Thermal power required	MW	WT	Partly

Economical data	
Daily operating hours	hours/day
Yearly operating hours	hours/year
Investment	€/kW
Operating & maintenance	€/kW

Adoption of **new business model replication tool** in order to overcome the major barriers for waste heat recovery solutions in energy intensive industries

Continuative communication and dissemination activities to advocate for policies implementation at EU level



PROJECT'S TEAM



TURBODEN

Solutions provider.
Project coordinator and developer of large heat pump and gas expander.



ORI MARTIN

Leading European supplier of high quality steel.
Utilizer of WHR solutions (ORC + LHP).



COGEN EUROPE

The European Association for the Promotion of cogeneration and waste heat .
Coordinate and execute communication and dissemination activities.



RINA

Engineering e consultancy company. Monitoring system design for technical and environmental performance and project replicability.



CSMT

Technological and research hub based in Brescia.
Dissemination, communication and networking activities.



a2a

Italian multi-utility, operating in the environment, energy, heat, grids and technologies for smart cities sectors.
District heating owner.
Utilizer of Gas Expander



<https://www.heatleap-project.eu/>



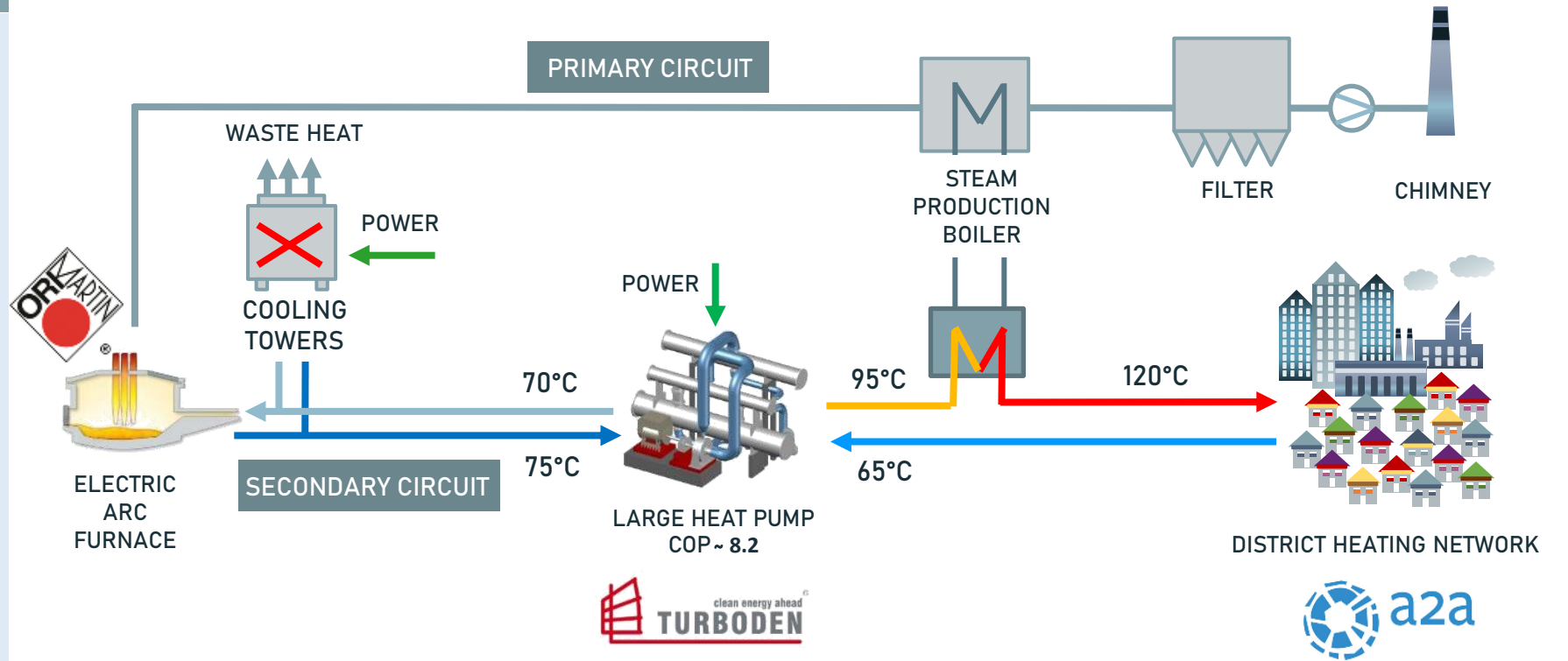
LARGE HEAT PUMP IN ORI MARTIN STEELWORKS



Low-grade waste heat (< 70° C) is often widely present in several Energy Intensive Industries, however it can be hardly valorised by using conventional technologies (e.g. organic Ranking cycles).
Conversely, some innovative technologies are emerging and can provide further energy improvement and CO₂ saving.

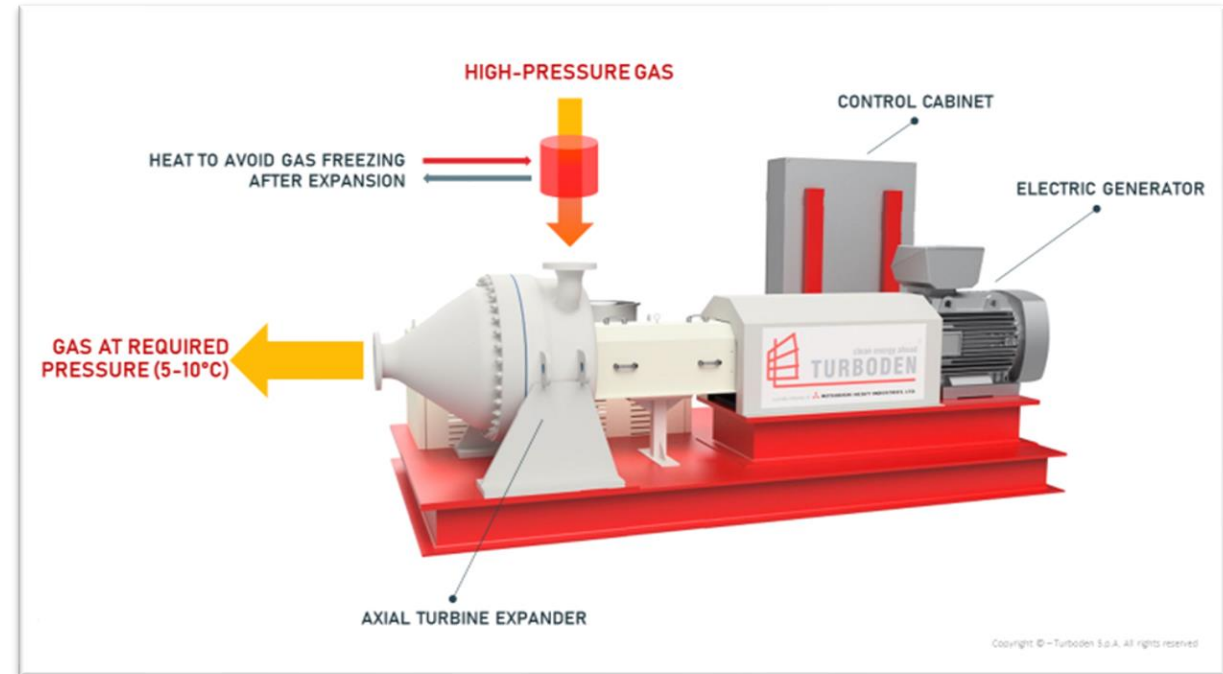
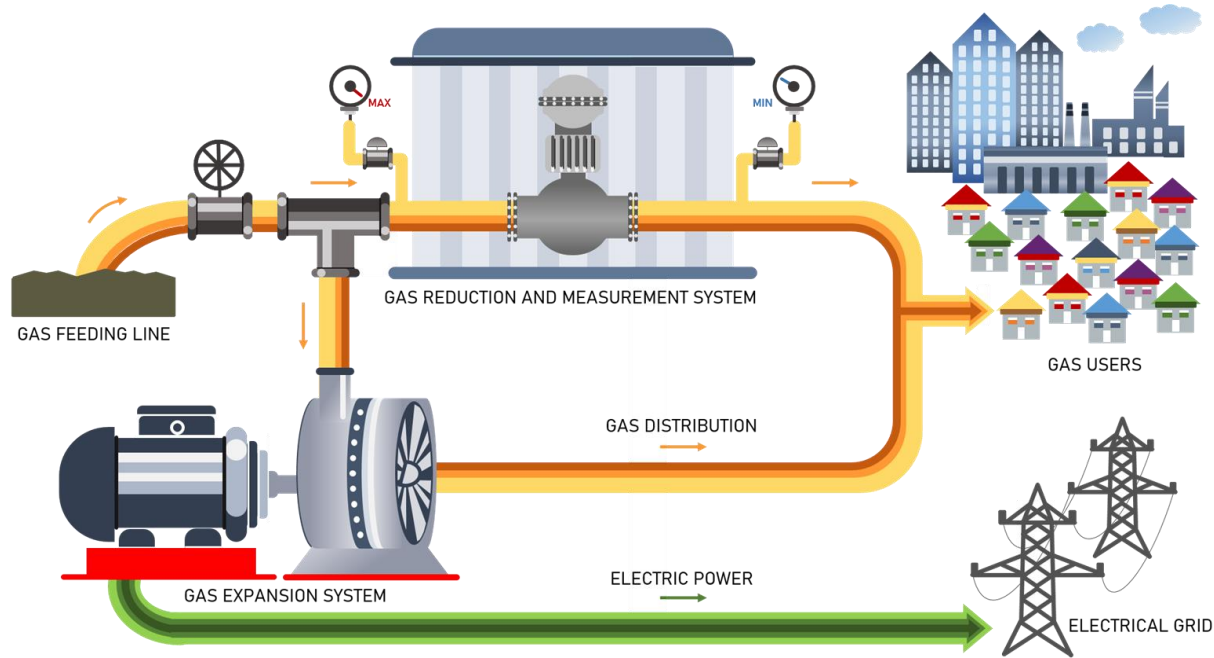
LHP TECHNICAL FEATURES

- **6 MWth** design, heat delivered with output temperature up to 120°C
- Full **integration** with DH network. Control system designed to be highly flexible depending on:
 - DH network operating temperature
 - Steam production boiler heat production
- **High flexibility** with 2 compression stages and variable frequency driver
- **Working fluid:** Low GWP HFO, R1233ZD





INNOVATIVE GAS EXPANDER: GAS DISTRIBUTION NETWORK



CONFIGURATION: power generation from gas pressure reduction within Brescia's gas network infrastructure

SIZE: 0.3 MWe

KEY FEATURE: 25,000 Sm³/h @ 12 - 6 barg

HIGHLIGHTS : smart city project – expansion of the gas entering the Brescia's gas distribution network, exploiting the district heating for the gas pre-heating



MONITORING SYSTEM



Monitoring System Design On-Line Implementation

PLC input

KPI calculation

Real time Data monitoring
(Currently Testing)

Real-Time LHP
produced Heat [W]

The screenshot shows the HeatLeap monitoring system interface. The top navigation bar includes 'Home', 'Impostazioni', and 'Cambia password'. The user is logged in as 'Ciao, Admin'. The main content area is divided into several sections:

- HeatLeap**: A sidebar menu with 'HeatLeap' highlighted in red.
- Segnali**: A grid of data points including:
 - Out temp. LHP: 40
 - In temp. LHP: 37
 - R1_HMI_DAT_TLR_T_IN: 51
 - R1_AI_TE_10NDA54_CT001.HMI_Value: 55
 - Potenza termica effettiva ceduta dal circuito ausilia...: 0
 - Flow rate output LHP: 1
 - R1_HMI_DAT_TLR_PT_OUT: 4
 - R1_HMI_DAT_TLR_PT_IN: 4
 - R1_AI_PT_10NDB54_CP001.HMI_Value: 4
 - Potenza termica effettiva ceduta dall'iRecovery al t...: 6.249
 - R1_AI_PT_10NDA10_CP001.HMI_Value: 6
 - R1_AI_FT_10NDA54_CF001.HMI_Value: 109
 - Potenza Elettrica Assorbita Dagli Ausiliari: 0
 - R1_AI_TE_10NDB54_CT001.HMI_Value: 55
 - Potenza termica effettiva ceduta al teleriscaldamen...: 6.249
- Thermal Heat prod. [W]**: A gauge showing a value of 4.129 W.
- Storico**: A section for historical data with filters for 'Elemento' (Tutti Gli Elementi), 'Da' (30/03/2023 00:00), and 'A' (31/03/2023 23:59).



REPLICATION TOOL



- **Tool to identify replication sites**

A tool was developed to standardize the approach regarding the preliminary identification of a potential plant where it is possible to implement the technology proposed by the HEATLEAP project.

The tool does not take into account the financial part but it is a support to find possible stakeholders.

Deliverable C3.2 - Tool to identify replication sites

- **Scope**

The different types of heat sources identified, and the major gas consumers indicate that there is huge potential for the installation of LHP and GEX.

The technical report and the tool set the basis to foster a wide replication of the WHR solutions and help to design innovative Business Models (BMs).

Data collection for evaluation of heat recovery potential from industrial processes

Date:	
Company:	
Type:	
Reference person:	
e-mail:	
tel.:	
Examined process/es:	

Technical data:
Note: starred data are mandatory for a preliminary evaluation

Cold source:

Heat Source (*):	e.g. Water, Air, ...		Mandatory data
Physical status:	Liquid/Vapour		
Inlet Temperature (*):		°C	Mandatory data
Outlet Temperature (*):		°C	If required
Flow rate (*):		m ³ /hr	Mandatory
		kg/s	
Thermal power available:		kWt	

Hot source:

Heat Source (*):	e.g. Water, Air, ...		Mandatory data
Physical status:	Liquid/Vapour		
Inlet Temperature (*):		°C	Mandatory data
Outlet Temperature (*):		°C	If required
Flow rate (*):		m ³ /hr	Mandatory
		kg/s	
Thermal power required:		kWt	If any

Economical data

Daily operating hours		hours/day
Yearly operating hours		hours/year
Electricity average cost		€/MWh
Heat average cost		€/MWht



POLICY ACTION & OVERVIEW



LARGE HEAT PUMP – POLICY SCENARIO



- **EC Target:** Doubling of the rate of deployment of heat pumps in the next five years and up to 30 million by 2030 (domestic-industrial);
- *EU association calculates around 20 million heat pumps by 2026 and nearly 60 million heat pumps installed in the EU by 2030;*
- HPs are included among the **8 Strategic Net Zero technologies (SNZT)**, that will receive support and are subject to the **40% domestic production benchmark**;
- **Heat Pump action plan:** Heat Pump accelerator call for evidence closes today;
- **NECP:** (National Energy and Climate Plan) to be submitted by Member States by June 30.





GAS EXPANDER – FIRST ACHIEVED RESULT - ITALY



In 2022 Italy has become the first and only EU Country to implement such a policy result.








Sommario

PROPOSTE/SEGNALAZIONI CRITICITÀ AL GSE VOLTE ALLO SVILUPPO DEL MERCATO DEI TEE E DELLA COGENERAZIONE



TAB 1 – Type of intervention

Type of intervention	Useful life (U) years		White Certificates typology
	New installation	Replacement	Type 1 Reduction of electricity consumption
Network, services and transport			
Electricity recovery from natural gas decompression	7	5	X



GAS EXPANDER – POLICY SCENARIO



Gas network in ITA



- NO obligation to distribute gas “in efficient way”;
- Energy efficiency investment are NOT covered in regulated tariff of DSO;
- BUT this Energy efficiency investment IS now eligible in the White Certificate scheme



Gas network in UE



- The economical feasibility and efficiency of the project is now proved;
- Still, Gas Expander is not mentioned in any EU decarbonization strategy;
- The “Energy efficiency first principle” should support these projects all around Europe





SAVE THE DATE



Final Dissemination Event

6 July 2023 – Afternoon

Brussels, Belgium

**Save
the
Date**